

BIO 104

Instructor: Avis Gibbons

Outline of Transcription (RNA Synthesis)

- 1) Transcription starts at a specific region of DNA called the **promoter**, which is located 5' to the beginning of the actual gene to be transcribed.
- 2) Proteins called **transcription factors** recognize the promoter and bind there.
- 3) An enzyme called **DNA-dependent RNA polymerase** binds to the promoter and the transcription factors.
- 4) This catalyzes unwinding of a segment of the DNA helix, breaking of hydrogen bonds between the bases of that segment, and binding of free RNA nucleotides to their complementary bases on the DNA template strand.
- 5) RNA polymerase does **not** need a primer. It hooks RNA nucleotides together in the 5' to 3' direction, forming the backbone of the RNA strand.
- 6) The growing RNA strand does not fully associate with the DNA template, so most of it dangles off to the side.
- 7) The process continues until RNA polymerase reaches a DNA sequence called a **terminator**.
- 8) The terminator causes RNA polymerase to stop transcription and to release the RNA molecule.
- 9) The DNA double helix comes back together.

If the immediate product of transcription is mRNA, it is called a **primary transcript** or **heterogeneous RNA**. It undergoes several **post-transcriptional modifications** before it leaves the nucleus:

- 1) Its 5' end is **capped** with a modified guanine nucleotide. The cap tells the ribosome where to begin protein synthesis.
- 2) The 3' end is capped with a "**poly-A**" **tail**, an attachment of about 200 adenine nucleotides. The tail facilitates transport of the transcript from the nucleus and protects the transcript from degradation during transport.
- 3) Genes contain some nucleotide sequences that do not express themselves in the protein product (noncoding sequences), and other nucleotide sequences that **do** express themselves in the protein product (coding sequences). Coding sequences are called **exons**, and noncoding sequences are called **introns**. A third kind of post-transcriptional modification involves removing the introns from the primary transcript and splicing the exons together. This is performed by a unit called a **spliceosome**, a complex of protein, RNA and the relevant intron.

After processing, the now **mature mRNA** is ready to leave the nucleus.